Certain Obſervations of the Midland Salt-Springs *of* Worceſter-ſhire, Stafford-ſhire *and* Cheſhire.

Of the Crude *Salt, which grows from the* Stone-powder *dejected by the ſaid* Brines *in Boyling. Of the* Specifick *difference betwixt* Sea *Salt and* Common *Salt.*

A way (which ſeems to be the true method of Nature) of Diſtilling Sweet *and* Freſh *Water from* Sea *Water, by the* Breath *of Sea* Plants *growing in it.*

That this Breath *probably is the* Material *Cauſe of the* Trade *or* Tropick Winds. *In a Letter to the Publiſher from the learned* Martin Liſter *Dr. of* Phyſick *of the Univerſity of* Oxon.

SIR,

I Made all the *Wiches* or noted ſalt Springs in my way home from *Bath*, the laſt Summer, and ſpent ſome few hours in the examining of them. And what particulars I found over and above not mentioned in the *Phil. Tranſact.* [f] where they are very accurately writ of, I am about to tell you, as follows.

But before I proceed I muſt needs bear witneſs to the truth of Dr. *Guidots* experiments, moſt of which I tried my ſelf at *Bath*, and find him to be a moſt *Authentic*, and faithful writer. I do only yet doubt of the exiſtence of *Bitumen* for I cannot find the Floating Scum when dryed to have any ſuch thing in it.

At *Northwich* in *Cheſhire* upon the *Weever* in 4 Pits is great plenty of *Brine*, it ſtinks of *Sulphur* Apparently in all the *Pits*; it becomes *Atramentous* with *Galls*.

Here are uſed *Sand Pans*, which are let down in the Corners of the great *Iron Boilers*, before the Salt ſhoots into grains, and theſe catch the Sand.

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[f] N. 53. N. 54. N. 142.

Beſides there are thick *Stone Flakes raiſed* from the Bottome of the ſaid *Iron Boylers*, once a week.

N. B. Within half a Mile of theſe *Brine Pits* at *Marberry* a Salt *Rock* was found by the *Augur* in boring for *Coals* [a].

Here, and at *Midlewich*, alſo at *Nantwich* and all along the *River Weever*, which are places many miles diſtant, ſink on either ſide of the *River*, and you will ſcarce miſs of *Brine*, as I was credibly informed by the moſt knowing men in that particular: But yet it proves a venture whether the *Brine* will be ſtrong enough to boyl, and turn to Account; and for this Reaſon their *Pits* ſometimes fail them, to their great loſs (as they ſhewed me one, which had been wrought to very great profit,) by a ſmall ſweet Spring breaking into it, and ſometimes the *River Weever* it ſelf does them this miſchief.

At *Nantwich* upon the ſame *River*, is one very large *Brine-Pit*: This water alſo plainly ſmells as it were corrupted, or like *Sulphur*, but notoriouſly upon a few days forbearance of the *Pit*. It becomes *Atramentous* with *Galls*.

It yeilds a *White Sand* or *Stone* adhering in the manner of thin Scales to the *Bottome* of the *Iron Pans*, in which the *Brine* is boiled. And thus much of the *Cheſhire Brine Pits*.

Weſton Brine Pit near *Stafford*. This water in the *Pit* Stinks like rotten *Eggs*: with *Galls* it becomes ſuddenly *Atramentous*. It Purges and Vomits violently, and that drank in a ſmall *Quantity*. Here are uſed *Sand-pans*, to catch the white Sand, and there are flakes of *Stone* alſo, raiſed from the bottome of the great *Iron Boylers*.

Droitwich in *Worceſterſhire*. The upper *Wich* or *Brine-Pit* is very neatly kept, and exceedingly drawn, becauſe there are ſo many *Proprietors*, and but a ſmall *Pit*, com-

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[a] Phil. Tranſ. N. 66.

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paratively to thoſe which have been named above.

Here the *Salt* is boiled in ſmall *Leaden Pans*, and there is not the leaſt grain of *Sand* at any time, which either falls before the *Graining* of the *Salt*, or that adheres to the *Pans* bottoms; [b] notwithſtanding what hath been ſaid to the contrary: and therefore this *Brine* being naturally without *Sand*, it muſt yeild the more wholeſome *Salt*.

The *Lower Pit* at the nether *Wich* in the ſame Town, hath but one Proprietor, as I remember, and therefore is leſs drawn, but yet is conſtantly and well wrought.

Here alſo is no news or knowledge of any *Sand* at all. The water of theſe *Pits* ſtinks like *Rotten Eggs*, eſpecially after Sundays reſt: And (N. B. *)* will, if fleſh be pickled in them, make it ſtink in 12 Hours.

And yet the *Salt* that is boiled out of theſe *Pits* is accounted the very beſt inland *Salt* of *England*, and I beleive as good as any in the world.

I doubt not but they are *Atramentous*; but I forgot to try them with *Galls*.

I obſerved in a Ditch over againſt the nether *Wich*-houſes, the water ſtanding with a *White Scum* as at the *Sulphur Spaws* in *York-ſhire*.

I ſhall add by way of Corollarie,

1. That all our *York-ſhire Wells* called *Sulphur Spaws* (which are many) are no other then ſo many *Brine Pits*, and if they were well drawn and wrought would be as little offenſive in ſmell.

2 That this *Stone-powder* is alſo to be found adhering to the *Iron-pans*, where the *Sea-water* is boiled into *Salt*, as it is at *Shields* in the Biſhoprick of *Durham*; But I do not remember it to be in the lead pans at *Med p* and *Miltbrop* in *Lancaſhire* where the *Sea Sands* are lixiviated, and that *Lixivium* boiled into Salt; nor is it remembred in the ac-

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b John Collins S. and Fiſh p. 8. 52.

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count given[c] of the making of *Sea-Salt* by *Inſolation*; Nor could I obſerve it in the leaſt in diſtilling of *Sea-water* in a *Glaſs ſtill*, or in the *Yorkſhire* ſtinking Wells, of which a good quantity is yearly made for *Medical* uſe or rather *Curioſity* to vend to Strangers.

N. B. This *Sand* falls to the Bottome before the *Salt* grains.

This is ſo alſo in all other *Mineral Salts*, whoſe Brines being boiled, ever let go firſt this *ſtony* part: the *Okar* falls in powder upon the firſt boyling but the *Lapis Calcarius* riſes in flakes like *Wafers*, which yet falls in powder by froſt, as we have elſewhere obſerved.

3. This *Stone powder* irrigated with fair water and kept moiſt does yeild an immature *Salt* of an uncommon figure; which I have deſcribed at large and figured[d].

4. Notwithſtanding the great *Affinity* betwixt the *Salt* of the *Midland Brine-Pits* which is *Common Salt*, and the *Sea Salt*: I muſt not omit (amongſt others[e]) a *ſpecifick* Difference, which is by me, (that I know of) now firſt publiſhed, and which, in my Opinion, makes the *Sea-Water*, a Water of its own kind: and alſo ſhews that none of the Productions of incinerated *Plants* are truely a *Marine Salt*.

The *Angles* of the *Cryſtals* of *Common Salt*, boiled out of the *Midland Brine-Pits*; as alſo of *Sal Gem* or *Rock Salt*, which I take to be one and the ſame, are intire, and ſo are all thoſe *Lixiviated-marine Salts* ſo called and deſcribed by Dr. *Grew*. But the *Angles* of the *Cryſtals* of true *Sea Salt* are ever ſome of them cut off into *Triangular planes*, at leaſt on one of the ſides. And this I learnt, by ſufferring a *Bottle* of *Sea Water*, taken up upon the *Coaſt* at *Scarborough* where no river near enters it, to evaporate leaſurely placed in the ſhade, after it had been half boiled away: and here all the *Cryſtals* (which were many,

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[c] Phil. Tranſ. N. 51. [d] De Fontib. Med. Angl. edit. 2. [e] N. B. The Inland Brine Pits yeild not bittern, of which ſee Mr. Collins. p. 54.

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and of different Magnitudes) did yet agree in a like *figure*, as is deſcribed.

This *Experiment* I repeated with the like ſucceſs; and do not doubt, but that it will ſucceed with any *Sea Water*, which ſhall be brought from any other part of the world, which this *Society* ſhall pleaſe to direct to be done.

Further, I ſay that probably the *Sea-water* was the only *Element* of *Water* created at the beginning. And the congregation of the waters was called *Sea. Genes.* 1. that is, before any *Animal* or *Vegetable* was created, or the *Sun* it ſelf. But upon the *Creation* of theſe the *freſh water* had its riſe accidentally, becauſe it owes its being in great part ([f] as I have elſewhere ſhewn) to the *Vapours* of *Plants* and the *Breath* of *Animals* and the *Exhalations* raiſed by the *Sun*. and by this means the *Rivers* may be furniſhed from the *Sea* by the Breath of its own *Plants* and *Animals*, ſo as to make what the wiſe man ſays very intelligible. *Eccles*: 1. All the *Rivers* run into the *Sea*, and the *Sea* is not full; into the place from whence the *Rivers* come, thither they return again; that is by way of *Exhalation* and *Vapours*.

5. Now that the *Sea water* is made *freſh* by the *Breath* of *Plants* growing in it,[g] I have elſewhere demonſtrated thus; I took a long *Glaſs Bodie* and having filled it pretty full with *Sea-water*, taken up at *Scarborough*, I put therein common *Sea weed* (*Alga Marina*) freſh and new gathered, ſome with the *Roots* naked, and ſome growing on and adhering to *Stones*: the *Glaſs Bodie* being full, I put thereon a *head* with a *Beck*, and adapted a *Receiver* thereto, all without any *Lute* or cloſing the joints; from theſe *Plants* did diſtil dayly (tho' in a ſmall quantity) a freſh, very ſweet, and potable Water, which hath no *Empegreuma*, or unpleaſant taſt, as all thoſe diſtilled by fire neceſſarily have.

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[f] De Font. Med. Angl. [g] De F. M. Angl.

I urge this *Experiment*, as the moſt *natural*, moſt eaſy, and moſt ſafe way of having *ſweet water* from the *Sea*, and which may be of greater uſe then perhaps ſome are apt at the firſt to fancy, even to ſupply the *Neceſſity* of *Navigators*.

6. And I do not doubt but there may be found other *Plants* growing in or near the *Sea* which would better ſuit the *Experiment* and yeild *freſh water* in much greater *quantity*; ſuch as *Rock Sampire* the *Kali kind*, or the *Braſſica Marina* &c. for all or any of theſe may be tryed how they will thrive in *Sea water* alone, or planted in earth well and daily wet with it.

Among the known *Sea Plants* the *Sargoſſe* or *Lenticula Marina*, is not to be forgot; this grows in vaſt quantities from 36 to 18 *Degrees Northern Latitude*, and elſewhere upon the deepeſt Seas. And I think (to ſay ſomething by the by of that great *Phænomenon* of the *Winds*) from the daily and conſtant breath of that *Plant*, the *Trade* or *Tropic Winds* do in great part ariſe: becauſe the matter of that *Wind*, coming (as we ſuppoſe) from the breath of only one *Plant*, it muſt needs make it conſtant and uniform: Whereas the great variety of *Plants* and *Trees* at Land muſt needs furniſh a confuſed matter of *VVinds*: Again the *Levant Breezes* are briskeſt about *Noon*, the *Sun* quickning the *Plant* moſt then, cauſing it to *breath* faſter, and more vigorouſly; and that *Plants* moſtly languiſh in the *night* is evident from many of them, which contract themſelves and cloſe at that time; alſo from the effects of our *VVinters* upon them, which cauſe them to caſt both fruit and leaves too; whereas they are ſaid (the ſame *Plants* for kind) univerſally to flouriſh all the year alike within the *Tropicks*.

As for the *direction* of this *Breeze* from *Eaſt* to *VVeſt*, it may be owing to the *General current* of the *Sea*, for a gentle *Air* will ſtill be lead with the *ſtream* of our *Rivers*, for example. Again every *Plant* is in ſome meaſure an *Heliotrop*, and bends it ſelf, and moves after the *Sun*, and conſequently emits its vapours thitherward, and ſo its *direction* is in that reſpect alſo owing in ſome meaſure to the *Courſe* of the *Sun*.